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Influence of hydrometeors on relativistic runaway electron avalanches

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Previously, all studies in this area of atmospheric physics, namely, avalanches of relativistic runaway electrons (RREA), were carried out without taking into account the presence of hydrometeors in thunderclouds, which could seriously affect the results and their correspondence to actually observed natural phenomena. Such as TGF(Terrestrial Gamma-ray Flash) and TGE(Thunderstorm Ground Enhancements), the cause of which is still not clear; which are observed in astroparticle experiments, for example, on the Fermi Gamma-ray Space Telescope. This talk takes into account hydrometeors in clouds. In this work, the distribution of RREA was simulated in GEANT4 was simulated taking into account various concentrations of ice particles. Modeling showed that accounting for the presence of hydrometeors cannot be simplified and reduced to a change in the main substance. Two methods are considered - modeling of volumetric hydrometeors as separate modeling objects and as a simple change in the components of a whole substance (adding water to air with a corresponding density). These methods show completely different results. Modeling by volumes of hydrometeors shows a decrease in the length of the avalanche by 20 %, on the other hand, when modeling with a modified material, the length changed only by 1 %. This suddenly proves that hydrometeors should be taken into account in research, as they can significantly change the growth length of an avalanche in real thunderstorm condition.

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